

WE CLAIM:

1. A device comprising:

a lower electrode;

a substrate formed on the lower electrode;

a triangle mesa structure formed on the substrate for lateral confinement of light;

a triangle optical cavity formed in the mesa structure;

an upper electrode formed on the mesa structure; and

a plurality of contact spots formed on the upper electrode corresponding to maxima of optical field intensity for at least one optical mode on a lateral plane in the optical cavity.

2. The device of claim 1 wherein the triangle mesa structure is truncated.

3. The device of claim 1 wherein the device is one selected from the group consisting of a light emitting diode (LED), a semiconductor laser diode, a resonance cavity LED, a unipolar semiconductor laser diode, a light output device, a semiconductor laser gyroscope and a semiconductor device generating light.

4. The device of claim 1 wherein the triangle optical cavity is truncated.

5. The device of claim 1 further comprising:
an additional plurality of triangle mesa structures formed on the substrate wherein each of the additional triangle mesa structures includes a structure generally the same as the triangle mesa structure;

5 an additional plurality of upper electrodes respectively formed
6 on and respectively corresponding to the additional triangle mesa structures;
7 and

8 a plurality of trenches providing optical connection among the
9 triangle mesa structure and the additional triangle mesa structures.

1 6. The device of claim 5 wherein the triangle mesa structure and
2 the additional triangle mesa structures are formed on the substrate in a
3 topology selected from the group consisting of an array, cascade, lattice,
4 super lattice, matrix, hollow matrix, hexagon and polygon.

1 7. The device of claim 5 wherein the triangle mesa structure and
2 the additional triangle mesa structures are truncated.

1 8. The device of claim 5 further comprising a light output structure
2 formed on the substrate for controlling light output direction.

1 9. The device of claim 8 wherein the light output structure is one
2 selected from the group consisting of a triangle, ridge, plane waveguides and
3 an optical fiber.

1 10. The device of claim 1 wherein the substrate is one selected
2 from the group consisting of n-GaAs, n-InP, n-SiC and sapphire.

1 11. The device of claim 1 wherein the triangle optical cavity further
2 comprises:

3 an upper waveguide mirror;
4 a lower waveguide mirror; and;

5 a waveguide layer disposed between the upper mirror and the
6 lower mirror for vertical confinement of the light.

1 12. The device of claim 1 wherein the triangle mesa structure
2 further includes an AlGaAs waveguide layer comprising:

3 an upper mirror selected from the group consisting of a p-type
4 AlGaAs cladding layer and p-type AlGaAs superlattice;

5 a lower mirror selected from the group consisting of an n-type
6 AlGaAs cladding layer and n-type AlGaAs superlattice; and

7 an upper contact layer made of p-type AlGaAs.

1 13. The device of claim 12 wherein the contact spots are shaped by
2 a process selected from the group consisting of non-uniform metal
3 deposition, metal deposition over a dielectric mask, non-uniform doping of
4 the upper contact layer, and ion-implantation treatment of the upper contact
5 layer.

1 14. The device of claim 1 wherein the contact spots are shaped by
2 a process selected from the group consisting of non-uniform metal
3 deposition, metal deposition over a dielectric mask, non-uniform doping, and
4 ion-implantation.

1 15. The device of claim 1 further comprising a buffer layer made of
2 BAIGaInN.

1 16. The device of claim 1 wherein the triangle mesa structure
2 further includes an InGaAsP waveguide layer comprising:

3 an upper mirror selected from the group consisting of a p-type
4 InP cladding layer p-type InGaAsP superlattice;

5 a lower mirror selected from the group consisting of an n-type
6 InP cladding layer, n-type InGaAsP superlattice and n-type AlInGaAs
7 superlattice; and

8 an upper contact layer made of p-type InP.

1 17. The device of claim 1 wherein the triangle mesa structure
2 further includes an InGaN waveguide layer comprising:

3 an upper mirror selected from the group consisting of a p-type
4 AlGaN cladding layer and p-type AlGaN superlattice;

5 a lower mirror selected from the group consisting of an n-type
6 AlGaN cladding layer and n-type AlGaN superlattice; and

7 an upper contact layer made of p-type AlGaN.

1 18. The device of claim 1 wherein the triangle mesa structure
2 further includes an InGaAs waveguide layer comprising:

3 an upper mirror selected from the group consisting of a p-type
4 AlGaAs cladding layer p-type AlGaAs superlattice;

5 a lower mirror selected from the group consisting of an n-type
6 AlGaAs cladding layer and n-type AlGaAs superlattice; and

7 an upper contact layer made of p-type AlGaAs.

1 19. The device of claim 1 wherein the triangle mesa structure
2 further comprises an active layer selected from the group consisting of
3 InGaAs/GaAlAs double heterostructure, InGaAs/GaAlAs single quantum well,
4 InGaAs/GaAlAs multiple quantum wells, and current asymmetric resonance
5 tunneling structure.

1 20. The device of claim 1 wherein the triangle mesa structure
2 further comprises an active layer selected from the group consisting of

- 3 InGaAsP/GaAlAsP double heterostructure, InGaAsP/GaAlAsP single quantum
- 4 well, InGaAsP/GaAlAsP multiple quantum wells, and current asymmetric
- 5 resonance tunneling structure.